



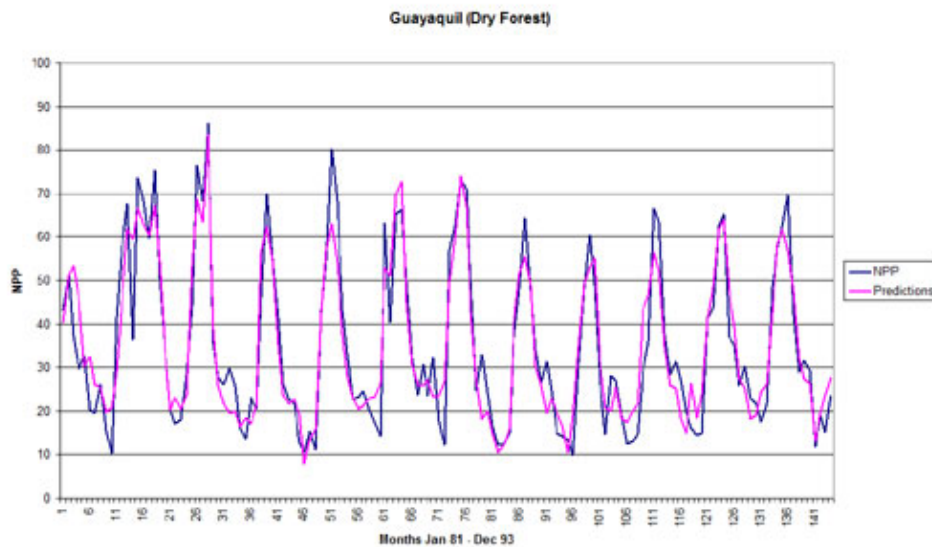
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Project Report: Hindcasting Ecosystems

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Project Progress

Using results from the previously NAI-funded study, we are developing a predictive Paleo-Net Primary Productivity model for South America (D'Antoni & Skiles 2004). The model is based on the remote sensing/ecology tradition lastly enumerated by Nemani et al. (2003) and the logic used by Monteith (1981) and Running (1990). For calibration and reference purposes we use the output of the NASA-CASA model (Potter et al. 2003) for 41 sites in South America. The sites have distinctive ecological settings and there are fossil pollen or tree-ring data available for these sites. We use modern data of variables likely to have proxies in the fossil record. Our model includes Normalized Difference Vegetation Index (NDVI) data from the advanced very-high-resolution radiometer (AVHRR) sensor at 8 km resolution. We have shown that "paleo" NDVI estimates can be extracted from fossil pollen data (D'Antoni & Schabitz 1995). The model also includes tropical Atlantic and Pacific Sea Surface Temperature (SST). We have reconstructed 750 years of past SST from tree ring widths (D'Antoni & Mlinarevic 2002). Modern solar irradiance data have recently become available (Fröhlich & Lean 2002; Foukal 2003). These data play an important role as a driver in our model. We are currently exploring potential proxies of solar irradiance in the fossil record. We are also using modern temperature and precipitation data in the model, proxies for which are found in fossil pollen and tree-rings. With Dr. Jorge Marcos (2004), we are establishing the observation bases for intensive studies in Ecuador. Additional sites in South America are being considered for testing the model.



Guayaquil (Ecuador) – NPP Simulations by our model (purple line) as compared to those by the NASA–CASA model (blue line).

References

D'Antoni, H.L. and Schäbitz, F. 1995. *Remote Sensing and Holocene Vegetation: History of Global Change*. World Resource Review 7 (2): 282–288.

D'Antoni, H.L. and Mlinarevic, A. 2002. Past Sea–Surface Temperature Derived from Tree–Rings. Astrobiology Science Conference 2002. [Abstracts] Presenter 29. NASA Ames Research Center, Moffett Field.

Foukal, P. 2003. *Can Slow Variations in Solar Luminosity Provide Missing Link Between the Sun and Climate?* EOS 84 (22), 205–208.

Fröhlich, C. and Lean, J. 2002. *Solar Irradiance Variability and Climate*. Astronomische Nachrichten AN 323 (3/4), 203–212.

Marcos, J.G., Alvarez Litben, Valverde, S. G., Badillo, F. de M., Ventimilla Bustamante, C.I., and Tobar Abril, O. 2002. Las Albarradas en la Costa del Ecuador. Rescate del Conocimiento Ancestral del Manejo Sostenible de la Biodiversidad. ESPOL. Guayaquil. 370p. + CD–ROM.

Monteith, J.L. 1981. *Evaporation and Surface Temperature*. Q.J. R. Meteorol. Soc., 107: 1–27.

Nemani, R. et al. (2003). *Climate–Driven Increases in Global Terrestrial Net Primary Production from 1982 to 1999*. Science 300, 1560–1563.

Potter, C., Klooster, S., Myneni, R., Genovese, V., Tan, P., and Kumar, V. 2003, Continental scale comparisons of terrestrial carbon sinks estimated from satellite data and ecosystem modeling 1982–98. Global and Planetary Change, 39, 201–213.

Running, S.W. (1990). Estimating terrestrial primary productivity by combining

remote sensing ecosystem simulation. IN: Ecological Studies Vol "Remote Sensing of Biosphere Functioning. H. Mooney and R. Hobbs. eds Springer–Verlag p 65–86.

D'Antoni, H.I. and Skiles, J. (2004). *Prediciendo Ecosistemas del Pasado en América del Sur* [Abstract]. AbSciCon 2004, NASA Ames Research Center , Moffett Field , CA . *International Journal of Astrobiology* , Supplement 1:10 .

Highlights

- We use databases recently made available (such as that of solar irradiance) that gives us a direct input from the solar energy source.

Roadmap Objectives

- **Objective No. 6.1: Environmental changes and the cycling of elements by the biota, communities, and ecosystems**

Mission Involvement

Mission Class*	Mission Name (for class 1 or 2) OR Concept (for class 3)	Type of Involvement**
2	MARTE	Research or Analysis Techniques

* Mission Class: Select 1 of 3 Mission Class types below to classify your project:

1. Now flying OR Funded & in development (e.g., Mars Odyssey, MER 2003, Kepler)
2. Named mission under study / in development, but not yet funded (e.g., TPF, Mars Lander 2009)
3. Long–lead future mission / societal issues (e.g., far–future Mars or Europa, biomarkers, life definition)

** Type of Involvement = Role / Relationship with Mission

Specify one (or more) of the following: PI, Co–I, Science Team member, planning support, data analysis, background research, instrument/payload development, research or analysis techniques, other (specify).

Spectroscopy analysis of samples with new, NASA–sponsored technology

Field Expeditions

Field Trip Name: Ecuadorian Dry Forest

Start Date: TBD	End Date: TBD
Continent: South America	Country: Ecuador
State/Province: Guayaquil	Nearest City/Town: Guayaquil
Latitude: 1 S	Longitude: 80 W
Name of site(cave, mine, e.g.): Dry Forest	Keywords: field measurements

Description of Work: Chlorophyll concentration measurements

Members Involved:

Cross Team Collaborations

Due to the nature of this project we have set a network of foreign collaborators in different regions of South America